BIOMIMETIC BUT ABIOTIC CARBONATES: NEW GEOCHEMICAL MARKERS FOR PRIMITIVE ENVIRONMENTS. J. M. García-Ruiz, Instituto Andaluz de Ciencias de la Tierra, CSIC-Universidad de Granada. Facultad de Ciencias. 18002-Granada, Spain (jmgruiz@goliat.ugr.es).

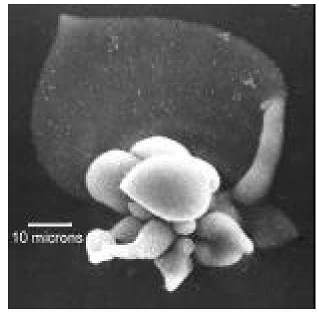
The unambiguous detection of ancient life is a crucial necessity in assessing the timing of life on our planet. Today, the strategy to reveal features of past life forms is also of utmost importance towards an approach to seek out living beings on other planets.

Among other very few biomarkers used today (stromatolite structures, autigenic minerals, biological degradation compounds and isotopic analysis), morphological recognition of living forms still plays a critical role in Precambrian micropaleontological studies. The underlying principle supporting life detection using morphological and textural tools derived from the old idea that inorganic precipitates are unable to produce neither shapes displaying certain symmetry groups nor certain bizarre textural arrangements. In this frame of mind, there is a substantial morphological difference between the inanimate and the animate worlds: it was thought that certain complex shapes with non-crystallographic symmetry were characteristic of life and would be impossible to obtain by inorganic precipitation. The most recent and conspicuous application of this "law" is the fossil-like microstructures found in ALH84001 meteorite.

However, it is known since years ago that morphological patterns with symmetry properties characteristic of living forms may also be precipitated by purely inorganic mechanisms. Many of them are irrelevant to life detection, as they are unlikely to occur under geochemical conditions. In few cases, on the other hand, complex inorganic shapes form under laboratory conditions emulating geological scenario, thus becoming of geological interest as they can be used as geochemical markers. This is the case of carbonate precipitation in silica-rich alkaline brines forming what I called induced morphology crystal aggregates [1]. The morphological emulation is particularly dramatic when barium or strontium carbonate are precipitated (exemplified in the figures shown) while textural emulation is clear in the case of calcite [2].

These biomimetic carbonates (of barium, strontium or calcium) patterns are obtained in the laboratory into alkaline silica-rich brines. Extreme as these conditions can be (pH > 10; silica concentration > 500 ppm), there are today few lakes, particularly in the African Rift Valley, where these precipitation environment can be found. Therefore, beyond a chemical curiosity or materials science innovation, this biomimetic carbonate precipitation is a plausible phenomenon under natural conditions [3].

Obviously, induced morphology crystal aggregation is an inorganic alternative to be considered when



using morphology as a biomarker. I claim in this communication the importance of considering this bizarre precipitation phenomenon when detecting primitive life here on Earth or on terrestrial planets. Silica biomorphs form into environments which are likely to be widely spread during earlier stages of the Earth and Mars, planets which are though to share a similar geological history during the Archean (Earth) and Noachian (Mars) periods [4]. In particular, some terrestrial Archean (baritic) cherts are though to be the result of inorganic silica-precipitation under alkaline conditions. Silica leached from alkaline volcanic rocks increases the pH and, since there were no silica absorbing organisms during the Archean times, the pooling waters becomes enriched in silica. This draws a extremely favorable geochemical scenario for the precipitation of silica biomorphs. Similarly, the process leading to precipitate carbonate particles with properties of induce morphology crystal aggregates is much likely to have been active in the geochemical scenario proposed for the carbonate formation in ALF84001 meteorite [5,6].

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